STRAPS: a Community-Based Study of Traffic-Related Particle Exposures and Respiratory Health Among Urban Youth

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Objectives:

The objectives of STRAPS were to: 1) characterize differences in school-based measurements of black carbon and other particulate species for schools that differ in local diesel traffic levels; 2) test whether respiratory health status of students (asthma diagnosis and/or respiratory symptoms) differs across schools as a function of ambient black carbon levels; 3) test whether daily respiratory symptoms correlate over time with ambient black carbon levels for asthmatic and/or non-asthmatic students; 4) determine the relative influence of exposures occurring at home, at school, and while commuting by using personal monitoring on a subset of students; 5) build the capacity of the community partners to conduct air quality monitoring and apply the results to their community work; and 6) assist school staff in introducing information on air pollution and health into the curriculum at the schools. We report preliminary results only for objectives 1 and 2 above.

We thank all the students, teachers, and staff from the high schools that participated in the present study. We also wish to thank the Board of Education of New York City and Rockland County for allowing us to conduct this study.
This study was supported by the National Institute of Environmental Health Sciences Grant No. ES11379 and Center Grant No. 5P30 ES009089.

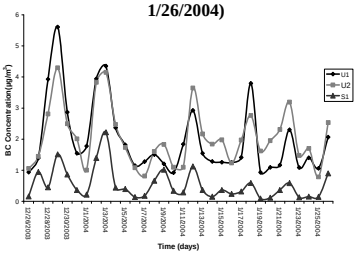
Air Intakes to Aethelometers overlooking highway

Characteristics of School Populations Assessed by Initial Survey

		U1	U2	S1
N		283	391	422
Sex (%)	Male	45.3	28.0	49.2
	Female	54.7	72.0	50.8*
Age (mean±SD)		16.5±1.3	15.9±1.2	16.8±.10
Race (%)	White, non-Hispanic	0.4	0.0	13.0
	Black, non-Hispanic	27.0	32.8	49.5
	Hispanic	67.1	55.2	11.7
	Other	5.5	12.0	25.7*
Father's Education Level (%)	< High School	31.3	25.2	10.6
	High School Graduate	46.0	47.2	35.6
	≥ College Graduate	22.7	27.6	53.8*
Lifetime Asthma Prevalence (%, 95% CI)*		30.8(27.3, 33.3)	29.4 (25.6, 33.2)	20.5 (18.2, 22.7)
Current Asthma Prevalence (%, 95% CI)*		20.8(17.8, 24.0)	19.4 (16.1, 22.7)	12.1 (10.3, 14.0)

* p<0.05 for difference between schools

Comparison of daily average BC levels at three schools (12/26/2003-1/26/2004)



Study Design

The study design called for monitoring air pollutants at four high schools in the NYC metropolitan area. One school, termed S1, was located in a suburban area with lower volumes of local traffic. Of the three urban schools, two were located in the Bronx (U1 and U2), and one in Manhattan (U3), and represented a range of local traffic impacts from moderate to high. The S1 school underwent air monitoring in each of the three years of study, to provide a comparison with each urban school being monitored in a given year. A different urban school was recruited and monitored in each of three successive academic years. Data are presented here from the first two years of monitoring (S1, U1, and U2). The U3 school sampling was completed in 2005 and will be reported in future documents.

Air measurements included school roof-top monitoring of black carbon and PM2.5 in real time (5 minute and hourly intervals respectively) over two or more months during the school year. Integrated filter-based PM2.5 sampling was carried out in some cases, but is not reported here. Health status and other basic student characteristics were assessed for approximately 300 students at each school based on an anonymous survey questionnaire. This was followed by recruitment of approximately 40 students per school who recorded respiratory symptoms on a daily basis over 4-6 weeks while ambient monitoring was underway.

High School Students looking at sampling equipment

Prevalence of Respiratory Symptoms Over The Previous 12 Months

	U1	U2	S1
Wheeze or Whistling in Chest			
Never	64.8	65.6	61.3
Once a Month or Less	15.3	15.8	21.2
Once a Week	6.9	6.4	6.0
More than Once a Week	13.0	12.2	11.5
Cough			
Never	8.5	12.0	7.3
Once a Month or Less	69.8	67.5	68.3
Once a Week	5.1	1.7	4.4
More than Once a Week	16.6	18.8	19.9
Shortness of Breath			
Never	49.1	60.6	50.9
Once a Month or Less	23.0	19.9	24.9
Once a Week	11.3	9.0	8.1
More than Once a Week	16.7	10.6	16.2
Medication for Respir. Symp.			
Never	62.9	62.0	64.3
Once a Month or Less	16.5	18.6	20.5
Once a Week	6.6	6.0	3.1
More than Once a Week	14.9	13.5	12.1
Urgent Visit to Doctor or Hospital for Trouble Breathing or Asthma over Previous 12 Months			
Never	75.2	78.2	90.5
One Time	11.7	11.7	6.2
Two Times	5.7	6.0	1.7
Three or More Times	7.4	4.1	1.7*

* p< 0.0001 for difference between this school and both U1 and U2.

DISCUSSION:

Concentrations of black carbon (BC) at two urban high schools (U1 and U2) were five-fold higher than at the suburban school after controlling for meteorological data. U2 was within 35 meters downwind of a major highway; U1 was about 38 meters upwind of a moderate highway. In spite of these differences in local traffic volumes, BC concentrations at U2 were only slightly higher than at U1. This may suggest that black carbon concentrations within the urban core of NYC are relatively well mixed .

Asthma prevalence was higher at the urban schools than at the suburban school after controlling for differences in gender, race, SES, and household smoking, all of which are frequently cited in the literature as risk factors for asthma. Although BC levels differed between urban and suburban schools and urban students reported higher frequency of residential truck and bus traffic, there may be other differences, not accounted for, between urban and suburban populations that might explain differences in asthma prevalence. Also consistent with other studies, we found that urban adolescents, compared with suburban adolescents, reported increased frequency of urgent visits to a doctor or hospital for asthma or trouble breathing, which may suggest increased frequency of severe acute exacerbation of asthma among urban residents. We did not find differences in frequencies of respiratory symptoms between urban and suburban school populations. Subsequent analyses, in which we will analyze the association between daily BC concentrations and daily respiratory symptoms and medication use recorded by study participants will allow more accurate assessment of the relationship between traffic-related PM such as BC and respiratory morbidity and minimize biases due to other differences between urban and suburban school populations.

NIEHS National Institute of Environmental Health Sciences

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